Chapter 5 - Applications of unsupervised learning

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Abstract

This chapter demonstrates how Unsupervised Learning can be applied in Geophysics. It starts with an example of clustering seismic spectra obtained on Stromboli volcano. K-means clustering as well as clustering using the Adaptive Criterion are applied. The latter criterion is preferred as it better matches the statistical characteristics of the data. Clusters show close relation to the state of volcanic activity. Density based clustering reveals groups whose hulls can be of irregular shape. This makes the method attractive, among others, for the identification of structural elements in geology, which often do not have a simple geometry. An example application is discussed considering the distribution of earthquake locations on Mt Etna, which clearly evidence structures already identified by other, independent evidences. Using SOM we aim at data reduction and effective graphical visualization. In an example for climate data we demonstrate the application of SOM for zoning purposes. Besides, the temporal evolution of spectral seismic data recorded on Mt Etna can be effectively monitored using SOM. We further illustrate the use of SOM for directional data, which can be handled best using a toroidal sheet geometry. We discuss this using a data set of seismic moment tensors of Mediterranean earthquakes.